

# Utility Interconnection Equipment Certification

The information on this form is provided to indicate the compliance of the generation equipment listed below with the utility interconnection certification requirements defined in California PUC Electric Rule 21

**Certifying Laboratory** *The information on this form is provided by the following Nationally Recognized Test Laboratory*

Laboratory: **Intertek ETL Semko**

Contact Name: **Frank Serra** Phone: **(905) 678-7820** E-mail: **frank.serra@intertek.com**

Address: **3210 American Drive**

City: **Mississauga** State: **ON** Zip: **L4V 1B3**

Accredited by: **OSHA** Date: **6/26/2006**

Accredited to (test standards)<sup>1</sup>: **Safety for Inverters, Converters, and Controllers for Use in Independent Power Systems, UL 1741 (First Edition, Dated May 7, 1999 including revisions up to November 7<sup>th</sup>, 2005)**

**Equipment Specification:** *The information on this form applies to the following equipment*

Equipment Manufacturer: **Fuel Cell Energy/Satcon Power Systems**

Address: **3 Great Pasture Road**

City: **Danbury** State **CN** Zip **06813**

Model Number(s): **Fuel Cell Energy Inc. Model # DFC1500MA using SatCon Power Systems inverter model AE-1500-60-F-U-XX**

Software Version(s): **PC01100-S070-C (Master Controller, rev.34), PC-1100-S071-C (Rack Controllers, rev.33)**

Effective<sup>2</sup>: **certification date June 29<sup>th</sup>, 2006**; covered inverter **Model AE-1500-60-F-U-XX series, serial number 94486-001 or later**

Device Description<sup>3</sup>: The products covered by this report are Power Conditioning Modules with forced air-cooling housed by 3 listed **Type 3R** enclosures. One enclosure (incorporates four 375 kVA inverters and a main controller cabinet) receives **DC power** from (external) fuel cells and converts it into **3Ø a.c. power** for utility-interactive applications. Second enclosure incorporates a Power Isolation Transformer. Third enclosure is the Switch Gear provides interface and protection between PCU and utility. All enclosures intended to be permanently installed in an unclassified, indoor/outdoor location. The Maximum ambient temperature is **40°C (104°F)**.

The unit (based on sample Model No. AE-1500-60-F-U) has following dimensions:

- 1) Inverter (Four PCS Racks) is **503cm (198")** wide, **254cm (100")** deep, **321cm (126-1/8")** high. The weight is approximately **13,600Kg (30,000 Lbs)**;
- 2) Switch Gear is **117 cm (46")** wide, **112 cm (44")** deep, **224 cm (88")** high. The weight is approximately **1,360 kg (3,000 Lbs)**;
- 3) Power Isolation Transformer is **198cm (78")** wide, **1686cm (66")** deep, **193cm (76")** high. The weight is approximately **3,946 kg (8,700 Lbs)**.

The product output is intended to have a point of common coupling with the grid on load side of the building service equipment (location category B)

## **Test Results<sup>4</sup>**

Mark the box next to each requirement that has been met and each test that has been performed and successfully passed. Provide an explanation of any exceptions or omissions on a separate sheet. List additional test documents used on a separate sheet

Result	Test	Standard Before 11/07/05	Standard After 11/07/05
<input checked="" type="checkbox"/>	Utility Interaction	UL1741 Sect. 39	IEEE1547.1 Sect. 5.2, 5.3
N/A	DC Isolation	UL1741 Sect. 40.1	IEEE1547.1 Sect. 5.6
<input checked="" type="checkbox"/>	Max. and min. input voltage	UL1741 Sect. 41.2	UL1741 Sect. 41.2
<input checked="" type="checkbox"/>	Dielectric Voltage Withstand	UL1741 Sect. 44	UL1741 Sect. 44
<input checked="" type="checkbox"/>	Output Ratings (included Power Factor)	UL1741 Sect. 45.2	UL1741 Sect. 45.2
<input checked="" type="checkbox"/>	Harmonic (Stand-Alone)	UL1471 Sect. 45.4.1	UL1741 Sect. 45.4.1
<input checked="" type="checkbox"/>	Harmonic (Grid Tie)	UL1741 Sect. 45.4.2	IEEE1547.1 Sect. 5.11
N/A	DC injection	UL1741 Sect. 45.5	IEEE1547.1 Sect. 5.6
<input checked="" type="checkbox"/>	Grid Abnormal Conditions (Utility Voltage and Frequency Variation)	UL1741 Sect. 46.2	IEEE1547.1 Sect. 5.2, 5.3
<input checked="" type="checkbox"/>	Reconnection to Grid	UL1741 Sect. 46.2.3	IEEE1547.1 Sect. 5.10
<input checked="" type="checkbox"/>	Anti-islanding Test	UL1741 Sect. 46.3 Rule 21 J3.b	IEEE1547.1 Sect. 5.7
<input checked="" type="checkbox"/>	Loss of Control Circuit	UL1741 Sect. 46.4	UL1741 Sect. 46.4
<input checked="" type="checkbox"/>	Short Circuit Test	UL1741 Sect. 47.3	UL1741 Sect. 47.3
N/A	Load Transfer Test	UL1741 Sect. 47.7	UL1741 Sect. 47.7
<input checked="" type="checkbox"/>	Surge Withstand Capability	Rule 21 J.3.e	IEEE1547.1 Sect. 5.5.2
<input checked="" type="checkbox"/>	Synchronization	Rule 21 J.3.f	IEEE1547.1 Sect. 5.4
N/A	Non-export	Rule 21 J.3.c	Rule 21 J.3.c
N/A	In-rush Current	Rule 21 J.3.d	IEEE1547.1 Sect. 5.4.4
<input checked="" type="checkbox"/>	Temperature Stability		IEEE1547.1 Sect. 5.1
<input checked="" type="checkbox"/>	RF Electromagnetic Field Immunity	IEEE Std C37.90.2-2004	IEEE Std C37.90.2-2004

Device Rating<sup>5</sup>: **Input: Voltage 250–500VDC, Current 4800A**  
**Output: Voltage 480VAC, Current (max) 1805A,**  
**Power 1200KW/1500KVA, Frequency 60Hz (3Ø)**

Maximum available fault current: **2166 A**

In-rush current<sup>6</sup>: N/A

Trip settings (Magnitude/Timing)<sup>7</sup>: (See test report for verification testing)

	Factory Voltage Setting	Factory timing Setting
Fast Over Voltage	<b>332 V</b>	<b>140msec</b>
Over Voltage	<b>304V</b>	<b>580msec</b>
Under Voltage	<b>244V</b>	<b>580msec</b>
Fast Under Voltage	<b>222V</b>	<b>140msec</b>
Over Frequency	<b>60.5Hz</b>	<b>140msec</b>
Under Frequency	<b>59.5Hz</b>	<b>500msec</b>
Fast Under Frequency	<b>57 Hz</b>	<b>160msec</b>

Note: Trip settings are field adjustable except Fast Under Frequency.

Nominal Power Factor (Range, if adjustable) Adjustable 0.8 to 1.0 at full load

Non-Islanding: Yes ☒ No ☐ Maximum trip time: \_\_\_\_\_

Non-Export: Yes ☐ No ☒ Method: \_\_\_\_\_

Other<sup>8</sup>: The Power Conditioning Module AE-1500-50-F-U-04 as representative sample was tested in accordance with UL1741 (First Edition, Dated May 7, 1999 including revisions up to November 7, 2005). The sequence of tests for Utility Voltage and Frequency Variation, Synchronization and Surge Withstand Capability was done according with order of Rule 21 Table J.2 “Type Tests Sequence for Interconnection Equipment Certification”.

Note. The measurement tolerance for the different settings is as follows:

SETTING	TOLERANCE RANGE
<b>Voltage</b>	<b>Nominal +/- 4 V</b>
<b>Frequency</b>	<b>Setting +/- 0.04 Hz</b>
<b>Time</b>	<b>Setting + 0 msec</b> <b>Setting – 40 msec</b>

Note: The measurements tolerance combines the accuracy of reading of Digital Controller Board and measurement equipment used during the test.

Notes:

- <sup>1</sup> Accreditation must apply to test standards listed herein.
- <sup>2</sup> Note here the date of certification, applicable serial number (range or first in series), or other information that indicates to which units the certification applies.
- <sup>3</sup> List appropriate functions, capabilities, applications, limitations, etc. Use additional sheets as necessary.
- <sup>4</sup> List all test documents (i.e. UL 1741, IEEE C62.45) and specific procedures (i.e. UL 1741 Sec 39.1 – 39.5, etc.) used to evaluate device's suitability for utility interconnection
- <sup>5</sup> For devices that use grid power to motor to speed.
- <sup>6</sup> For devices that use grid power to motor to speed.
- <sup>7</sup> Enter trip magnitude, Voltage in volts or frequency in Hz, and trip timing, in cycles into each square (Magnitude/Timing). Devices with adjustable settings shall provide test results over the range of settings. For each test setting provide the setting values in the upper box and measured results in the lower box. List device ranges, if adjustable. Show data for one phase (greatest % difference between setting and measured magnitudes as well as the maximum trip time for that setting). Provide data for all phases (on additional sheets) if measured trip values for any two phases differ by more than 3% (for the same setting).
- <sup>8</sup> Provide any additional information that may be useful in evaluating these results such as test configurations, device settings used to meet requirements, etc. Use additional sheets if necessary.